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Teaching Computers to See Like We Do | College of Engineering

11/18/2015

Nov. 18, 2015 – Recognizing patterns might be easy for some people, but it's a difficult skill to teach to a computer. Ask Dr. Xiaojun Qi, a faculty member in USU's Computer Science Department, who was recently promoted to professor for her innovative research in image processing and computer vision.

Qi is helping engineers at the Utah Water Research Lab, or UWRL, better manage digital photos. Aerial photography has become a key resource in recent years as researchers develop imaging-based tools that can help farmers get a better handle on irrigation and crop efficiency.

The UWRL uses a fleet of autonomous aircraft that snaps thousands of high-resolution images used in precision agriculture studies. The challenge is piecing all those pics together to make one big map.

Her work represents the latest advancements in orthorectification – a fancy term for the process of making aerial photos look the real thing.



"Basically what we're doing is trying to put all these skewed pictures into the right place," explained Qi. "The challenge is that these are very large, high-resolution images."

The task can take days to complete using existing software tools. Qi is trying to change that with an elegant program that takes the guesswork out of assembling the photos – and one that takes just hours to complete instead of days.

"The software they use now requires a person to monitor the progress and stop the sequence if there are missing pieces," she explained. "Sometimes flight conditions can affect the quality of the photos. If there are errors in the images, those errors are propagated down the line, and the end result doesn't work."

Qi's software creates a low-resolution version of each image before the pictures are stitched together. This allows the system to determine if the sequence of photos can be assembled correctly and, if not, the software alerts the pilots that a repeat flight may be required.



In other work, Qi is pioneering new tools in various computer vision-related applications, including face and pedestrian recognition, object recognition, digital watermarking and information hiding. Digital watermarking allows users to copyright photos using embedded code that's invisible to someone who, for example, may be using the image without permission.

Another application is in authenticating video content. The same code can be hidden inside a video file and be used to verify the authenticity of the footage. The technology has broad possibilities for protecting content against doctoring or other manipulation.

Qi presented this and more at her Inaugural Lecture – a USU tradition in which newly-promoted professors share their work with the president of the university along with family and friends.

The professor was promoted in April. She grew up in Shenyang, China and received a bachelor's degree in computer science from Donghua University in Shanghai in 1993 and a master's degree in pattern recognition and intelligent control from Shenyang Institute of Automation, at the Chinese Academy of Sciences in 1996. She received a Ph.D. in computer science from Louisiana State University at Baton Rouge in 2001.

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Photo caption: Xiaojun Qi presented her Inaugural Lecture on Nov. 11 with USU President Stan Albrecht, Provost Noelle Cockett, College of Engineering Dean Christine Hailey and Computer Science Department Head Dan Watson, right, in attendance.

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